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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.
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09/233,073    01/19/99    NANBU    K    033082W001

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EXAMINER

VINH, L

ART UNIT

PAPER NUMBER

1765

DATE MAILED:

04/24/00

**Please find below and/or attached an Office communication concerning this application or proceeding.**

**Commissioner of Patents and Trademarks**

# Office Action Summary

Application No.  
09/233,073

Applicant(s)  
Kenichi Nanbu et al.

Examiner  
Lan Vinh

Group Art Unit  
1765



☒ Responsive to communication(s) filed on 3/15/00

☒ This action is **FINAL**.

☐ Since this application is in condition for allowance except for formal matters, **prosecution as to the merits is closed** in accordance with the practice under *Ex parte Quayle*, 35 C.D. 11; 453 O.G. 213.

A shortened statutory period for response to this action is set to expire 3 month(s), or thirty days, whichever is longer, from the mailing date of this communication. Failure to respond within the period for response will cause the application to become abandoned. (35 U.S.C. § 133). Extensions of time may be obtained under the provisions of 37 CFR 1.136(a).

## Disposition of Claim

☒ Claim(s) 1-14 is/are pending in the application.

Of the above, claim(s) \_\_\_\_\_ is/are withdrawn from consideration.

☐ Claim(s) \_\_\_\_\_ is/are allowed.

☒ Claim(s) 1-14 is/are rejected.

☐ Claim(s) \_\_\_\_\_ is/are objected to.

☐ Claims \_\_\_\_\_ are subject to restriction or election requirement.

## Application Papers

☐ See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.

☐ The drawing(s) filed on \_\_\_\_\_ is/are objected to by the Examiner.

☐ The proposed drawing correction, filed on \_\_\_\_\_ is ☐ approved ☐ disapproved.

☐ The specification is objected to by the Examiner.

☐ The oath or declaration is objected to by the Examiner.

## Priority under 35 U.S.C. § 119

☒ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

☒ All ☐ Some\* ☒ None of the CERTIFIED copies of the priority documents have been  
☐ received.

☒ received in Application No. (Series Code/Serial Number) 09/233,073.

☐ received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

\*Certified copies not received: \_\_\_\_\_

☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

## Attachment(s)

☒ Notice of References Cited, PTO-892

☐ Information Disclosure Statement(s), PTO-1449, Paper No(s). \_\_\_\_\_

☐ Interview Summary, PTO-413

☐ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Notice of Informal Patent Application, PTO-152

--- SEE OFFICE ACTION ON THE FOLLOWING PAGES ---

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## DETAILED ACTION

### *Claim Rejections - 35 USC § 103*

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1-6, 11-14 are rejected under 35 U.S.C 103(a) as being unpatentable over Collins et al. ( US 5,556,501 ) in view of Szwejkowski et al. ( US 5,338,398 ).

Regarding claims 1-3 of the instant claimed invention, Collins discloses an etching method using a plasma reactor chamber having an inductively coupled antenna driven by RF energy for etching metals, dielectric and semiconductor material. This etching method comprises the steps of:

supplying etching gas through a main gas inlet manifold into the internal vacuum processing chamber ( Col 7, lines 55-59 );

developing an etching plasma inherently produces plasma radical in the processing chamber upon application of RF energy to the etching gas ( Col 7, lines 62-65 );

etching polysilicon on silicon wafer in the processing chamber 16B connected to the plasma source chamber 16A by flowing gas from the plasma source chamber downward toward the wafer

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located in the processing chamber ( Col 22 , lines 45-46 and Fig.1 and Col 8, lines 16-18 ),  
evacuating the processing chamber by a throttle valve ( Col 7, lines 39-41 );

supplying etching gas of Chlorine at a flow rate of 50cc to the processing chamber to etch  
polysilicon film ( Col 22, lines 45-48 ).

Regarding claim 2, Collins discloses that RF energy is supplied to the plasma source chamber  
using a coil for efficient inductive coupling ( Col 8, lines 4-14 ).

Regarding claims 11-14, Collins discloses using total chamber pressure of about 0.1mTorr to  
200mTorr for etching ( col 9, lines 40-41 ).

Collins differs from the instant claimed invention as per claim 1 by supplying etching gas of  
Chlorine at a flow rate of 50cc instead of an etching gas supply rate of 8.4 sccm or above for a  
substantial volume of one liter of the processing chamber as claimed in the instant invention.

Szwejkowski discloses a process for the RIE etching a polysilicon film on a silicon wafer in a  
vacuum etch chamber using Chlorine etching gas at a rate of from about 40 to about 100 sccm  
into a 3 liter vacuum processing chamber ( 40 sccm/ 3liter= 13.3 sccm/liter within the range of  
8.4 sccm to 16.9 sccm for a substantially volume of one liter ) ( Col 4, lines 19-22 ).

Szwejkowski also discloses that the pressure inside the vacuum chamber may range from about  
10mTorr -100mTorr ( col 3, lines 33-34 )

Hence, one skilled in the art would have found it obvious to modify Collins's etching gas flow  
rates by using the etching gas flow rate as taught by Szwejkowski because Szwejkowski states  
that using the gaseous component and flow rate of his invention will not result in the undesirable

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formation of particles on the wafer surface and will not condense at room temperature in the lines used to bring the etchant gases to the vacuum etch chamber ( Col 5, lines 49-54 ).

3. Claims 7-10 are rejected under 35 U.S.C 103(a) as being unpatentable over Collins et al. ( US 5,556,501 ) in view of Szwejkowski et al. ( US 5,338,398 ) and further in view of Tomita et al. ( US 5,593,540 ).

Collins and Szwejkowski have been described above in paragraph 2. Unlike the instant claimed invention as per claims 7-10, Collins and Szwejkowski do not disclose providing a flow rate of the etchant which produce a flow rate diverging position with respect to an outer periphery of an object ( wafer ) being etched.

Tomita discloses a plasma etching method comprises a step of distributing gas flowing speed ( flow rate ) linearly increases ( diverging position ) from the center of the wafer to reach the highest speed in the peripheral portion of the wafer ( col 7, lines 21-24 ).

One skilled in the art would have found it obvious to modify Collins and Szwejkowski by providing a flow rate of etchant to produce a flow rate diverging position with respect to the outer periphery of the wafer as per Tomita in order to achieve uniform concentration of etchant in the central portion of the wafer .

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*Response to Arguments*

4. Applicant's arguments filed on 3/15/2000 have been fully considered but they are not persuasive.

In regard to claims 1-3, the argument that there is lacking any indication or suggestion that the flow rate of the reference of Szwejkowski ( microwave plasma etching ) is equally applicable to a different method and apparatus of the reference of Collins ( inductively coupled plasma etching ) is not persuasive because it is well known in the art of plasma etching to employ inductively coupled plasma etching to RIE etch polysilicon and Szwejkowski discloses a process for RIE etching of tungsten/polysilicon on a semiconductor wafer ( col 2, lines 34-36 ). In addition, both Collins ( col 9, lines 28-43 ) and Szwejkowski ( col 3, lines 32-35 ) disclose plasma etching system of low pressure and high density as well as the use of electrodes in Collins ( col 8, lines 45-46 ) and in Szwejkowski ( col 3, lines 39-41 ). The examiner asserts that the flow rate of Szwekkowski ( microwave plasma etching ) is equally applicable to a method of Collins ( inductively coupled plasma etching ).

The new ground of rejection that regarding claims 7-10 is necessitated by applicant's amendment.

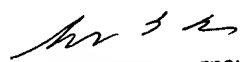
5. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

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A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

*Conclusion*

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Lan Vinh whose telephone number is (703) 305-6302. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Benjamin Utech, can be reached on (703) 308-3836.

  
BENJAMIN L. UTECH  
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LV

April 20, 2000